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taken as damning a book that is, in fact, at the head of the list for the purposes for which intended. It is merely to point out to non-mathematical statisticians that this is not *the* book for which they are waiting.

Indeed, the reviewer is inclined to think that that book cannot be written by a mathematician. His habits of thought and expression are against his success. Even if he could overcome that, his professional pride would stand in his way. That book must translate the mathematics of the subject into non-scientific language carrying over as few original expressions as possible. It will be a work, not of scholarship, but of adaptation of expression based on full knowledge of statistical practice. That would bring little credit to the author as a mathematician, and might well commit him to professionally childish work. That book will have to be written by one of the boneheads themselves who, by dint of perseverance, shall have learned the language of mathematics and then, having no mathematical reputation at stake, can dare to write with complete disregard of the highbrow standards of good form in mathematical discussion. His own full knowledge of statistical processes and his fellow feeling for his confrères will induce him to address them understandingly.

ARTHUR SARGENT FIELD.

Washington, D. C.

The Mathematical Theory of Population, of Its Character and Fluctuations, and of the Factors which Influence Them. Appendix A. Vol. I. Census of the Commonwealth of Australia. By G. H. Knibbs, C.M.G., F.S.S., F.R.A.S., etc., Commonwealth Statistician. Published under instruction from the Minister of State for Home and Territories, Melbourne, 1917. Pp. iv, 466.

The above monumental work represents a veritable milestone in statistical theory, which is emphasized by the fact that it has received almost universal praise from a number of leading statisticians the world over. Mr. Knibbs, the eminent statistician of the Australian Government, is by no means unknown to students of advanced statistical methods. His previous contributions have never been voluminous verbalisms, a very commendable but unfortunately rare occurrence in statistical literature. What they lack in quantity of paper they make up in originality and scholarship. The former small pamphlets from the hands of Mr. Knibbs have always brought to the present reviewer a very refreshing breeze of stimulating thought and a stream of new and original ideas. They have always been admirable in their brevity and lucid expression and stand in a class by themselves as examples of a clear and lucid exposition of thought.

One would therefore naturally expect something really valuable in this new tome of the Australian statistician. But even our fondest expectations were surpassed by the receipt of this massive volume of more than 460 large octavo pages, which for all times will stand as one of the leading works on mathematical statistics of the twentieth century. Not that the volume affords easy reading—on the contrary, I readily confess that I have not as yet mastered several pages of the intricate analysis. But this shows the real character of the volume as something different from a mere text-book and marks it as a true piece of research work, which for many years to come will form a most valuable mine of information for future statisticians to work in. In that respect it is equal to the French classics on the calculus of probability by Laplace and Poisson, the works of Quetelet and the recent researches by Lexis and Bortkiewizc, Bachelier, Pearson, Edgeworth, Thiele, Westergaard, Charlier and Peano.

Knibbs, like his Scandinavian colleagues among the mathematical statisticians, shows a close familiarity with the leading works in various languages on the theory of statistics, the classical as well as the modern literature. While most English, American, French and German works on theoretical statistics have become hopelessly one-sided specimens of a particular school of statistical method, the unbiased and intimate knowledge of our Australian author adds greatly to the breadth and value of his work, at least for those who have a fairly good knowledge of international statistical literature. The footnotes show how busy a reader Mr. Knibbs has been of the foreign statistical literature. To students of small nations like those of the Scandinavian countries this becomes natural, because they must often publish their articles in two and often three journals of different countries of varying language to get a hearing before a larger body of readers than those of their own countries. The English writer on statistics does not encounter this obstacle (if it can be called so), and the knowledge of Mr. Knibbs of foreign writings in at least half a dozen languages is therefore very praiseworthy and probably accounts for his ability to select the most typical and important parts of such foreign writings as well as his own originality of handling his material. Take for instance the third chapter on "Curve Constants and Intermediate Values," and the following chapters on "Special Types of Curves," "Group Values" and "Summation and Integration," where the footnotes indicate that Mr. Knibbs has read nearly all the available mathematical literature and nevertheless been able to present a new and wholly original treatment, which especially becomes very instructive in his generalized flexible probability or frequency curves. Mr. Palin Elderton and Mr. Udny Yule, the well-known English statisticians, in their respective reviews of the present work in the *Journal of Institute of Actuaries* and the *Journal of the Royal Statistical Society* claim that the material has become bewildering in its detail and that our author has somewhat crowded out the methods of Professor Pearson and others in preference to his own. This I consider a picayune criticism and a very narrow-minded attitude. The very recent statistical methods as developed by my own Scandinavian compatriots, Charlier, Wicksell, Akeson and Jörgensen, and to which I also have contributed in a very modest measure, mainly following in the footsteps of Laplace and Poisson, are not mentioned by Knibbs. This fact should, however, not prevent one from giving unstinted praise to the excellent methods of Mr. Knibbs in deriving the equations of his flexible frequency curves.

In the chapter on nuptiality an equally interesting description of a method of correlation is given in detail with the necessary mathematical formulaes and the protogamic surface.

The chapter on mortality is especially attractive. It is perhaps here more than anywhere else in the book that the author shows how advanced he really is in modern statistical matters. While other authors are content to harp on the old methods of constructing mortality tables along the well-known orthodox lines, Mr. Knibbs investigates the secular changes in mortality by a mathematical process and shows the necessity of constructing what he terms "fluent life tables." In the same connection he discusses also what he calls the "plasticity curve" as well as the composite character of aggregate mortality according to age and according to causes of death. Mr. Knibbs is here touching upon the same ideas which of late years have been taken up by the Scandinavian school of mathematical statistics, although by a different mode of treatment. He divides causes of death as regards *relative* frequency according to age in four typical groups.

In a brief space like this it is of course impossible to do full justice to a work planned on so large and broad a scale. A few selections from the foreword might, however, not be out of place. Mr. Knibbs says here that

"In the realm of official statistics there is an enormous amount of accumulated material, which decade after decade, remains unanalyzed and uninterpreted. This is due to several things, viz., to the fact that routine tabulations largely occupy the energies of the staffs of statistical bureaux, to the fact that much of the mass of material is defective and its correction involves more time than is available, and perhaps still more to the fact that appropriate schemes of mathematical analysis have as yet either not been developed, or are regarded as inapplicable."

In the present monograph Mr. Knibbs has materially advanced our knowledge of such mathematical methods and all earnest students will be thankful to him for it. The Australian Government also deserves high praise for having made possible the publication of this volume. We doubt whether public money has ever been expended in a better undertaking of statistical publications than the present work by the eminent scholar of the young and vigorous nation under the Southern Cross.

ARNE FISHER.

Harald Westergaard: "Statistikens Teori i Grundrids" (Outline of the Theory of Statistics). Second edition, completely rewritten, pp. 430, large octavo. Published through a grant of the University of Copenhagen by the C. E. Gad Publishing Company, Copenhagen, 1916.

This is one of the most important text-books on the theory of statistics that has appeared in recent years, and even a belated review of it may be welcomed by American readers for several reasons. Professor Westergaard is one of the leading statisticians of the world and has produced one of the finest treatises ever written on the theory of statistics. But the prime motive in penning this review is to correct certain erroneous opinions which we believe many English-speaking students are likely to form